INVERSE PHYSICS-BASED MODELING OF THE 2016 MW 6.1 TOTTORI EARTHQUAKE

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The 2016 Mw 6.1 Tottori earthquake occurred in the central part of the Tottori Prefecture in western Japan. Published rupture models inferred either from geodetic or seismic data exhibit significant differences. In this study, we perform so-far missing dynamic rupture simulation to improve the understanding of the event. We utilize a finite-difference staggered grid code fd3d_tsn_pt to simulate the dynamic rupture propagation assuming the classic linear slip-weakening (SW) friction law on a planar vertical fault. We thus obtain a spatiotemporal distribution of slip rates and tractions on the fault. Synthetic seismograms are obtained using the representation theorem through the convolution of slip rates with Green's functions precalculated in 1D velocity models.

Firstly, we perform a parametric study considering simple elliptical distributions of prestress and SW friction law parameters using low-frequency seismic data to find an optimal distribution of the dynamic parameters that best fits the observed seismograms. We obtain various models of possible slip evolution on the fault, however, the fit of the seismograms especially at very close distances is not satisfactory.

Secondly, we perform a dynamic source inversion with spatially variable parameters formulated in a Bayesian framework, employing an MCMC approach to sample the posterior distribution of the model parameters. We use low-frequency seismic waveforms and GNSS displacements with various weights to explore their resolution power. We obtain model samples with complex rupture propagation with an improved fit of the recorded waveforms with respect to the simpler elliptical models. We discuss the inferred rupture parameters such as the stress drop, radiated energy, fracture energy and rupture velocity.